whether in connection with precipitation or not, causes an equally sudden fall of the river as on April 1, 1901; January 1, 1902; March 6, 1902; December, 1902, and February, March, and April, 1903. This is more marked if the ground be bare or has only a light covering of snow. Observe that in April, 1900, the total precipitation for the month was only 1.21 inches, but the run off of the river was maintained at more than 20,000 cubic feet per second for a week by snow melting during warm weather. Notice the close parallelism of the run off and temperature profiles during this month of April, 1900, and then compare this month with April, 1901, when the precipitation was excessive, amounting to 7.91 inches. The snow on the ground on the higher portion of the drainage basin was only ordinary, yet in combination with the warm rains the river discharge for about twenty-four hours during the parts of two days in April, 1901, reached 35,000 cubic feet per second. If the rains of 1901 had come in combination with a snow accumulation like 1900, as it sometimes does, the river discharge might have again equaled 55,000 cubic feet per second as it did in April, 1895.

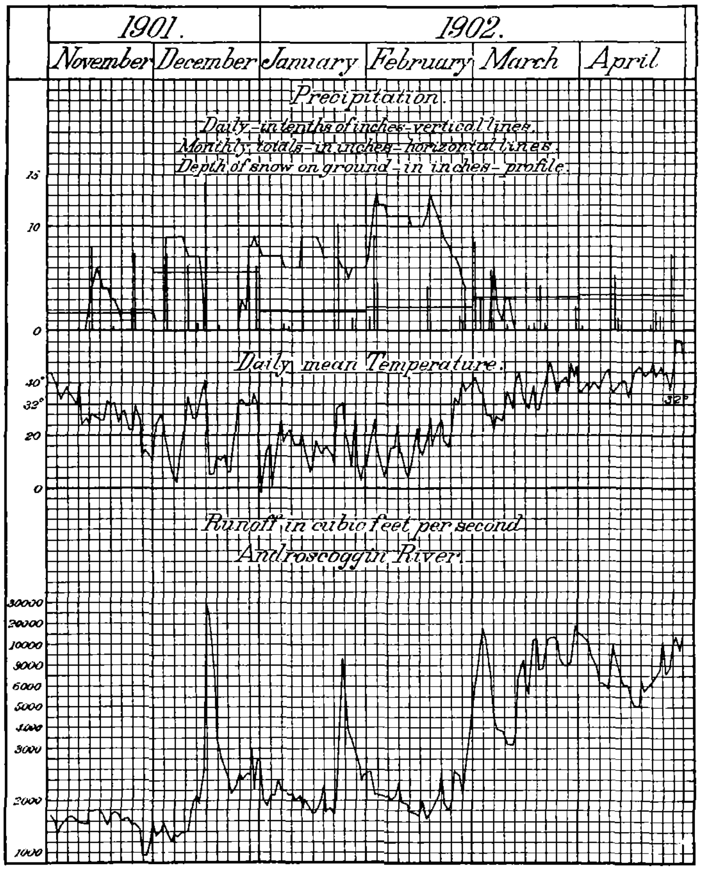

FIG. 3.—River and weather observations at Rumford Falls, Me.

All the conditions of the winter of 1901–2 were unusual. The entire season was broken and disturbed. Note the irregular monthly precipitation, coming generally with temperatures higher than 32°. The ground was bare twice; high water occurred in December, 1901, January, and March, 1902, each time carrying out the ice. The river discharge about the middle of December (made up of an ordinary amount of snow on the ground and a warm rain) was nearly 28,000 cubic feet per second, which was without precedent for the month of December. The usual spring freshet in March or April did not occur in 1902, because there was no snow on the ground and no hard rains fell. The winter just passed (1902–3) was approximately normal, excepting that it ended early, and the snow was carrried off earlier than usual by the unprecedented high temperature of March last. There were no heavy rains, and an ordinary spring run off was maintained as controlled naturally by the temperature and the snow on the ground. Notice again the parallelism of the temperature and the run off profiles during March and April, 1903.

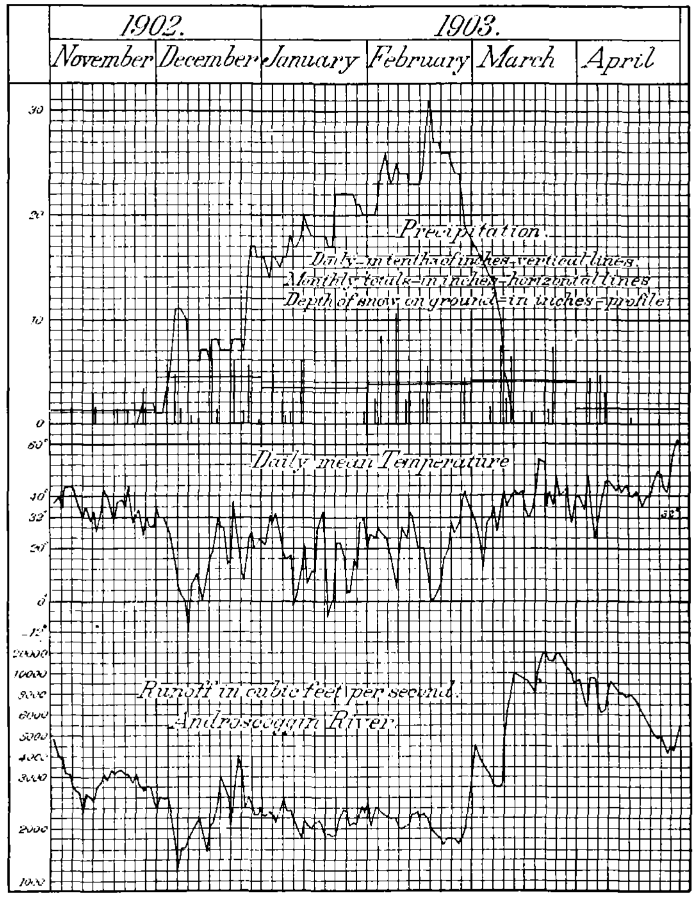

FIG. 4.—River and weather observations at Rumford Falls, Me.

Of course the limited observations and records of these four winters are not sufficient to establish any rules, but much can be learned from them. Other interesting and instructive conditions, combinations, and results may be found in these diagrams. I do not believe that another recent period as short as this could have been selected that would show so many different and extreme conditions.

TYPICAL OCTOBER WINDS ON OUR ATLANTIC COAST.

By T. H. DAVIS, dated April 13, 1903.

In Scribner's Magazine for June, 1902, there is an article by Harvey M. Watts on "The Gulf Stream myth and the anticyclone." While very much of his writing is logical and scientific he appears to me when dealing with the north Atlantic cyclone to be just as strongly imperative as was M. F. Maury with his cherished Gulf Stream. My attention has been particularly drawn to Mr. Watts' Chart No. IV, and I have made a comparison between his supposed wind directions at Boston, New York, New Haven, and Philadelphia, and the actual observations for the past eleven years at those stations. The result is that this chart does not present the winds prevailing on a typical October day.

Moreover, his explanation of so-called Indian summer, warm waves, and mild spells, does not seem to be in accordance with what are considered the fundamental principles of meteorology. Granting that the permanency of the north Atlantic cyclone is absolutely established, and that its annual north and south tropical migrations are scientific truths, how can it be shown that the anticyclonic effects can be manifested along its western margin more at one season than another? It does not seem to me in accordance with our knowledge of meteorology. In my researches into wind frequency I have not discovered any proof that there are any such lateral movements of the Atlantic anticyclone, as stated by Mr. Watts in his paper.

I think that closer observation of wind direction, viz, to 16 points of the compass instead of 8, or in fact to the nearest 10° of azimuth would be of immense value in absolute determinations, and would prevent the indiscriminate placing of arrows showing such directions of wind as bear out individual conceptions of accepted theories.

I am, and expect always to be, a champion of the theorem that the relative frequency of the directions of the wind is one of the fundamental principles of meteorology.

The accompanying five tables for stations on our Atlantic coast show that the most frequent directions for October are as follows:

Boston, west; New Haven, southwest; New York, west; Philadelphia, northwest. Whereas Mr. Watts' charts give: Boston, southeast; New Haven, east of south, or possibly south-southeast; New York, east of south; Philadelphia, west of south; Washington, south-southwest.

The dignity of meteorology as a science can only be maintained by adhering closely to observed natural phenomena. We shall make no progress by popular discussions of suppositious events.

TABLE 1.—*Observed frequency of wind directions for the month of October.*

Year.	Boston.								
	N	NE	E	SE	S	SW	W	NW	C
1891..	4	4	3	1	1	6	6	6	0
1892..	2	1	1	1	1	6	11	8	0
1893..	1	3	4	2	3	7	5	6	0
1894.	2	6	4	1	2	6	8	2	0
1895..	3	2	1	1	2	6	7	9	0
1896..	6	5	1	1	3	4	7	4	0
1897..	5	5	2	1	2	6	4	6	0
1898..	4	2	5	1	4	5	5	5	0
1899..	4	3	4	1	2	6	5	6	0
1900..	4	8	1	1	2	6	4	5	0
1901..	2	0	2	2	3	9	6	7	0

Year.	New York.								
	N	NE	E	SE	S	SW	W	NW	C
1891..	2	5	1	2	3	6	2	10	0
1892..	1	1	1	2	2	11	3	10	0
1893..	2	4	2	4	5	5	1	8	0
1894..	4	6	1	1	5	5	5	4	0
1895..	3	3	2	1	4	6	4	8	0
1896..	5	5	1	1	4	4	3	8	0
1897..	3	9	2	1	3	6	2	5	0
1898..	2	5	4	5	3	3	2	7	0
1899..	2	5	3	3	3	4	4	7	0
1900..	3	4	6	2	3	5	2	6	0
1901..	2	2	1	3	3	8	3	9	0

Year.	Philadelphia.								
	N	NE	E	SE	S	SW	W	NW	C
1891..	2	6	2	2	0	6	2	11	0
1892..	1	3	0	1	2	8	4	12	0
1893..	5	4	4	3	2	4	3	6	0
1894..	2	5	4	1	3	5	5	5	0
1895..	5	4	1	0	3	5	4	9	0
1896..	8	4	1	1	2	4	4	7	0
1897..	4	10	2	2	2	6	2	3	0
1898..	3	4	3	5	4	3	2	7	0
1899..	5	6	2	2	1	9	2	4	0
1900..	5	6	4	2	2	5	3	4	0
1901..	4	2	2	3	3	6	5	6	0

Year.	Washington.								
	N	NE	E	SE	S	SW	W	NW	C
1891..	4	5	2	1	5	2	2	9	1
1892..	3	2	1	1	5	3	4	11	1
1893..	5	7	1	2	5	3	2	5	1
1894..	5	3	2	2	5	2	3	7	2
1895..	5	3	0	2	6	2	3	10	0
1896..	6	4	1	2	6	1	2	8	1
1897..	7	9	1	1	7	2	1	2	1
1898..	3	4	4	3	5	1	3	7	1
1899..	5	5	4	2	6	1	1	4	3
1900..	3	6	3	3	5	1	2	6	2
1901..	2	3	2	5	5	2	2	8	2

Year.	New Haven.								
	N	NE	E	SE	S	SW	W	NW	C
1873..	6	3	1	2	3	5	3	4	4
1874..	5	3	1	1	3	6	5	6	1
1875..	8	4	1	1	1	7	5	3	1
1876..	3	2	0	1	1	8	5	8	3
1877..	7	4	2	1	1	7	1	6	2
1878..	6	3	1	1	6	6	4	4	0
1879..	2	3	1	3	2	8	4	7	1
1880..	4	2	1	2	5	5	4	8	0
1881..	8	3	1	1	3	9	2	3	1
1882..	7	8	2	2	3	4	2	3	0
1883..	11	5	2	1	5	2	1	4	0
1884..	7	2	0	0	2	9	3	7	1
1885..	5	5	2	2	5	4	3	4	1
1886..	4	9	1	1	4	4	2	4	2

Year.	New Haven.								
	N	NE	E	SE	S	SW	W	NW	C
1887..	6	4	1	1	4	4	6	4	1
1888..	4	3	0	1	2	3	5	11	2
1889..	3	10	1	1	3	3	4	6	0
1890..	4	9	1	1	1	2	4	6	3
1891..	8	6	0	2	1	6	3	4	1
1892..	3	2	1	0	3	5	8	8	1
1893..	7	4	2	3	2	6	3	4	0
1894..	7	4	2	0	1	6	7	3	0
1895..	7	2	1	1	3	4	5	8	0
1896..	12	3	1	1	2	4	4	4	0
1897..	8	9	0	2	2	4	3	3	0
1898..	8	4	1	2	5	3	4	3	1
1899..	8	8	1	3	2	4	3	1	1
1900..	8	7	1	2	1	4	3	5	0

Commenting on the preceding communication, Mr. Harvey M. Watts writes to the Editor as follows:

This is a very interesting contribution, although I do not at all agree with Mr. T. H. Davis in the conclusions that he has drawn from the study of the minutiæ of local wind movements. As is very apparent all through the year, our warm spells on the Atlantic coast are due to an aerial mechanism which consists primarily in high pressures over the Southern States, particularly over the Gulf of Charleston and even farther north, in conjunction with low pressures in the northwest or north. This mechanism is so regular in its effects that I do not think that any study of local winds can in any way controvert it. Perhaps I lay too much stress on the anticyclone itself, but the condition which best favors the warm waves is when the continental anticyclone has moved down over the Gulf of Charleston, and is there seemingly held up by merging with the general anticyclone of the Atlantic basin. I am also sure that investigations will show that the climatic variations which seem so anomalous are due to the strengthening of the tropical anticyclonic belts which in turn affect the paths taken by the continental cyclones and anticyclones, which in turn determine seasonal variations.

As neither Mr. Davis nor Mr. Watts has told us what data were used in compiling the maximum frequency or prevailing direction of the wind, the Editor would remark that the frequency of the wind directions during any month will differ according as we study observations made at one or another hour of the day. No general statement as to relative frequency can be made except after eliminating the diurnal change. The isobars in the eastern part of the United States do not change very much diurnally, whereas the winds do so. Thus, on the Atlantic coast we may have a strong sea breeze by day and land breeze at night, while the general isobars are calling for a steady southeast or southwest wind. A station that is subject to land and sea breezes or to lowland and mountain breezes is, therefore, not in a position to give us a fair idea of the relation between isobars and winds unless we eliminate the diurnal variation of the wind. These remarks may be illustrated by Table 2, which gives the frequency of each wind direction during October, 1901, as shown by hourly observations (see Annual Report, Chief of Weather Bureau, 1901–2, p. 43); by observations at 8 a. m. and 8 p. m. (see Annual Report, p. 117), and by observations at 8 a. m. only (see the published morning weather maps).

TABLE 2.—*Wind frequency.*

Wind direction.	New York.			Boston.			Philadelphia.			Washington.		
	24 hours.	8 a. m. 8 p. m.	8 a. m.	24 hours.	8 a. m. 8 p. m.	8 a. m.	24 hours.	8 a. m. 8 p. m.	8 a. m.	24 hours.	8 a. m. 8 p. m.	8 a. m.
North	40	4	3	38	6	3	84	6	3	55	6	3
Northeast	54	7	6	8	0	0	57	4	6	79	6	4
East	34	3	1	41	1	1	44	2	2	52	3	3
Southeast	76	5	1	38	4	1	73	8	1	126	9	3
South	76	8	1	74	8	3	82	8	1	114	10	5
Southwest	183	14	11	215	15	7	146	10	8	39	2	2
West	64	5	1	146	14	5	114	12	2	36	1	1
Northwest	217	16	7	184	14	11	143	11	8	192	20	10
Calm	0	0	0	0	0	0	1	1	0	51	5	0

The most frequent directions for October as given by our authorities are as follows:

TABLE 3.

Station.	Weather Bureau records.			Davis' Tables.	Watts' Chart.
	24 hours.	8 a. m. 8 p. m.	8 a. m.		
Boston	SW.	SW.	NW.	W.	SE.
New Haven	....	....	....	SW.	E. of S. or SSE.
New York	NW.	NW.	SW.	W.	E of S.
Philadelphia	SW.	W.	SW., NW.	NW.	W. of S.
Washington	NW.	NW.	NW.	....	SSW.

But the count of hourly frequencies and the charting of "most frequent" winds in connection with the monthly isobars tell us very little. The trend of an isobar and the trend of the wind that accompanies it are closely connected as cause and effect. These trends, occurring simultaneously and associated together, must be recorded daily and studied together; this still remains to be done for the United States, and this work can not be properly replaced by the study of charts of most frequent winds, or even of resultant winds, and average isobars.

There can be no doubt that the "tropical high" of the North Atlantic is subject to large changes in position and intensity.—*C. A.*